Political Stability, Corruption and Trust in Politicians

Ingmar Schumacher

ECOLE POLYTECHNIQUE

CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE

POLITICAL STABILITY, CORRUPTION AND TRUST IN POLITICIANS

Ingmar SCHUMACHER

Cahier n° 2012-38

DEPARTEMENT D'ECONOMIE

Route de Saclay

91128 PALAISEAU CEDEX

(33) 1 69333033

http://www.economie.polytechnique.edu/

mailto:chantal.poujouly@polytechnique.edu

Political Stability, Corruption and Trust in Politicians

(forthcoming in Economic Modelling)

Ingmar SCHUMACHER[1]

November 24, 2012

Abstract

In this article we develop a dynamic model where an endogenous evolution of trust impacts a politician's choice for bribe-taking and tax re-distribution. The politician obtains utility from net income that comes from his wage income, tax embezzlements and bribe-taking, and he also has incentives for tax re-distribution. The higher the tax embezzlements and the more bribes the politician takes the lower his citizens' trust and the less likely will he be re-elected. We support the evolution of trust with an econometric investigation.

We analyze the necessary and sufficient conditions, and find that withholding taxes and taking bribes may be complements or substitutes for a politician, depending on the politician's incentives for tax re-distribution. Without these incentives, tax embezzlement and bribe taking are necessarily substitutes. With sufficiently strong incentives, we find re-distribution and bribe-taking may become complements. Complements implies that the politician, at least partly, increases bribe-taking because this allows him to increase re-distribution, which aids his additional motives for tax re-distribution.

Based on comparative statics at steady state we also find that the higher the politician's wage the lower the bribe-taking and the higher the trust; stronger social capital leads to less bribe-taking and higher levels of trust; improvements in electoral accountability induce a decrease in bribing while trust increases.

Keywords: trust; corruption; political stability; bribe; dynamic model.

JEL Classification: D73; H11; E10; K42.

[1]IPAG Business School, 184 bd Saint-Germain, 75006 Paris; and Department of Economics, Ecole Polytechnique Paris, France, Tel: +352 621264575, email: ingmar.schumacher@ipag.fr.
I am grateful to an anonymous referee for his comments.

Contents

1 Introduction

Corruption is a widespread phenomenon that penetrates most societies. For example, over 80 percent of firms in Uganda report that they need to pay bribes (Svensson [52]). This is only topped by Burundi, where around 90 percent of all companies suggest that bribing is a standard practice (Dobson [25]). In a field experiment in Indonesia, Olken [47] found that roughly a third of the money for road projects had been stolen. Di Tella and Schargrodsky [23] concluded that measures to diminish corruption led to a substantial reduction in prices at hospitals in Buenos Aires.[1] Having corrupt officials is, generally, not in the interest of voters, yet we know that some corrupt regimes can actually stay in power over an extended period of time while others cannot. Thus, one would imagine that voters trade off several variables when it comes to considering whether a corrupt politician should be re-elected or not. The focus in this article is to study the incentives for a corrupt politician to influence those variables.

When one looks at the correlation between perceived corruption and trust in politicians in a cross-section of countries,[2] then one finds a significant negative correlation between the two (Figure 1). One also finds a strong negative correlation between corruption and political stability (Figure 2) but a positive correlation between trust and political stability (Figure 3). The purpose of this article is to present a model that is able to explain the aforementioned correlation from a politician's perspective. The claim forwarded and studied in this article is that leaders know that they require their citizens' trust in order to continue their political career. This trust is, however, evolving endogenously. We suggest that politicians reduce the trust that their citizens have in them when increasing their bribe-taking, but may increase trust via a higher level of re-distribution from taxes. Corruption, in our setting, thus consists of bribe-taking and money withdrawn from taxes.[3] In our model, corruption affects trust negatively and the amount of trust feeds back in the probability of being overthrown, either

[1] Many further examples are found in the book by William Easterly *The Elusive Quest for Growth* [26] and the Transparency International Global Corruption Reports.

[2] Perceived corruption and political stability are taken from the Governance Indicators by Kaufmann et al. [39], while trust is taken from the Eurobarometer 71.1.

[3] Thus, the type of corruption that we consider here is not efficient corruption as defined in Aidt [2], but we study official corruption as defined in Nye [46]. Official corruption is a "behavior which deviates from the formal duties of a public role because of private-regarding ... pecuniary or status gains" (Nye, [46], p.419).

by a democratic vote or by force. Thus, the political instability in this article should be understood as the endogenous probability of being 'relieved' from office. We then study how a politician trades off bribe-taking and re-distribution', and therefore trust, with the probability of staying in office.

Our main findings are as follows. Withholding taxes and taking bribes may be complements or substitutes for a politician, depending on the politician's social incentives[4] for tax re-distribution. If the politician has negligible social incentives, then tax embezzlement and bribe taking are necessarily substitutes. In this case, a reduction in trust from higher bribe-taking needs to be optimally offset by an increase in trust from a larger re-distribution. The politician chooses the mix of tax embezzlement and bribe-taking that leads to his desired level of trust, which affects his probability of being re-elected. In case social incentives are strong drivers of the politician's actions, then re-distribution and bribe-taking may become complements. Complements imply that the politician, at least partly, increases bribe-taking because this allows him to increase re-distribution which aids his social motives. One would, in practice, expect tax re-distribution and bribe-taking to be substitutes.

We find that the higher a politician's income the lower the bribe-taking and the higher the steady state trust. Thus, assuming that a politician's income is proportional to his citizen's income, then different GDP levels can be an underlying factor explaining the cross-country correlations in Figures 1 - 3. This is in line with Billger and Goel [14], who conclude that richer countries have consistently lower levels of corruption. Indeed, though their empirical results only suggest something about correlation instead of causality, our analytical model presents a possible causal channel. Our results are also in line with Besley [12], who relates a politician's pay and performance. His main findings are that better performance goes along with higher pay.

Our next result is that stronger social capital leads to a lower level of a politician's bribe-taking and a higher level of steady state trust. This corresponds to the line of literature starting with Putnam [49] and followed up in La Porta et al. [40]. They find that social capital is positively related to good economic outcomes across countries. Similar results have

[4]We call these social incentives, but they could be moral ones, altruistic ones or even egoistic ones, in case e.g. the taxes re-distribute increase a public good from which the politician benefits.

been obtained in Fukuyama [31], Alesina and Glaeser [3], Algan and Cahuc [7] as well as Guiso, Sapienza and Zingales [37], [38].

Finally, we show that improvements in electoral accountability induce a decrease in bribing while steady state trust increases with improvements in electoral accountability. Intuitively, the stronger the impact of trust on the probability of staying in office, the higher are a politician's incentive to improve trust and thereby increase the probability of staying in office. We, therefore, reveal a possible relationship between media and informational problems in elections. These links have been shown empirically in various studies. For example, Djankov et al. [24] find a significant correlation between media ownership and election outcomes. Whoever owns the press may significantly alter election outcomes. Similarly, Strömberg [51] shows how the media can affect the re-distribution of taxes (through the New Deal stimulus), while Brunetti and Weder [17] conclude that a free press may reduce corruption. In a slightly different line of research, Ferejohn [28] and Chowdhury [20] have shown that democracy has a significant impact on corruption through electoral accountability. Similar results are in Billger and Goel [14], who conclude that democracy may reduce corruption levels for the very corrupt regimes but at diminishing rates.

Research on political instability and economic or social factors is now accumulating. The relationship between political instability and growth derives from Grossman's [36] analysis of insurrection. In countries where rulers are relatively weak, i.e. more easily overthrown, the probability of revolutions is higher and the citizens have higher incentives to engage in revolutionary activities. Barro [10] finds that measures of political unrest, such as the number of assassinations and the occurrence of revolutions and coups, significantly affect the cross-sectional growth rates. A similar result is found in Alesina et al. [5]. In contrast to this, Campos and Nugent [18] do not find a causal effect from political instability to economic growth (only a marginally significant one for the sub-Sahara African subsample). Alesina and Tabellini [6] examine the effect of political uncertainty on investment and capital flight. Other studies on corruption include Uslaner [54], who regresses trust on corruption and finds a negative correlation; openness and corruption (Ades and Di Tella [1], Treisman [53], Baksi et al. [8]); coordinated rent-seeking behavior and corruption (Blackburn and Forgues-Puccio

[16]); corruption and economic growth (Mauro [42]).

The article is structured as follows. In section 2 we describe our view of the evolution of trust that a politician holds in society. We substantiate the assumptions by an empirical analysis based on the World Value Survey dataset. We also describe how a politician's is likely to estimate the probability of being voted out of office. Section 3 introduces the model setup, followed by an analysis of the necessary and sufficient conditions. We then discuss the dynamics of the model. In section 4 we use the model to explain several results that have, so far, only been shown empirically without a theoretical foundation. Finally, section 5 concludes.

2 Trust and political stability

In this section we provide our basic assumptions on the evolution of trust in politicians, the implications for political stability, and the underlying empirical evidence.

2.1 Modeling the evolution of trust

Let us define $X > 0$ as the constant and exogenously given amount of taxes that a politician obtains, and $R_t \geq 0$ as the amount that he re-distributes. We allow for $R_t > X$, which implies that the politician may re-distribute own funds. The politician may also take bribes, B_t. The amount of trust, denoted by T_t, that a politician holds is then an increasing function of the amount that he re-distributes relative to the taxes that he receives, where we denote the voters' perception of relative re-distribution by $G(R_t - X)$. Trust is also non-linearly decreasing in the bribes that he takes, modeled through function $F(B_t)$.

Assumption 1 *$G : \mathbb{R} \to \mathbb{R}$, and $\exists \hat{R} > 0$, such that $G(R_t - X) > 0$, $\forall R_t > \hat{R}$ and $G(R_t - X) \leq 0$, $\forall R_t \leq \hat{R}$. $G_R > 0$, $G_{RR} < 0$. $F : \mathbb{R}_+ \to \mathbb{R}_+$, $F(0) = 0$, $F_B > 0$, $F_{BB} > 0$.*

We characterize changes in trust over time by the equation

$$\frac{dT_t}{dt} = G(R_t - X) - F(B_t) - \delta T_t,$$

with $T_t \in [0, \infty)$, $\forall t$.

The more bribes a politician takes the lower will be the trust that he receives from his voters. Bribes, therefore, act as a loss of reputation. It is reasonable to assume that more bribe-taking implies an increasing loss of trust. Small levels of bribes might be more easily unnoticed or tolerated by the voters, whereas large levels of bribes should lead to significant decreases in trust.[5] If the politician re-distributes too few taxes to his voters, then this decreases their trust in him, and after a certain amount of re-distribution this increases the trust he obtains. The value of $\hat{R}$ represents the level of re-distribution at which voters believe that their taxes have been used efficiently. The value of X itself might include money from taxes, development aid and other official sources. It is reasonable to assume that for a sufficiently large amount of bribe-taking it becomes more and more difficult to compensate this behavior with redistribution up to the point where increases in bribes reduce overall trust again. Total corruption in this model is then the amount of bribes plus the amount of taxes withheld.[6] We also allow for $R_t > X$, which implies that a politician would pay re-distribution from his own income.[7] Finally, we suggest that trust depreciates over time. Intuitively, voters are assumed to forget the potentially good deeds of a politician over time.

2.2 Modeling political stability

Our assumptions concerning the endogenous political stability are as follows. At date $\tau > 0$ the politician will have lost a sufficient amount of his voters' trust and will therefore be stripped of his position. He faces uncertainty over the exact time at which this may occur, but knows that the timing of this event is also depending on the trust that his voters hold in him. We assume that the politician uses a Poisson function to describe the evolution of uncertainty. The probability of being voted out of office[8] at date τ is therefore equal to the

[5] Obviously, a politician's power to take bribes depends on the governmental structure. Highly vertical structures can imply difficulties to implement certain forms of bribery that are otherwise more easily realized in more horizontal structures, see e.g. Gerring and Thacker [32] and the discussion in Bardhan [9]. The shape of function $F(B)$ can accommodate this issue.

[6] This is related to the argument in Mauro [43], who shows the existence of a negative correlation between perceived corruption and government expenditure.

[7] For example, politicians sometimes finance their own election campaigns.

[8] The reader might be inclined to feel that this model only applies to forceful removal from office in non-democratic governments since we assume potentially unlimited terms in office and an uncertain timing of

cumulative distribution function $F_\tau = P(s \leq \tau) = 1 - \Delta_\tau$, where Δ_τ is the survival function, which is the cumulative distribution function of not having been 'relieved' from office until time τ. Thus, $\Delta_\tau = \exp\{-\int_0^\tau p_s ds\}$, where $p_s = \lim_{\epsilon \downarrow 0} \left(\frac{\Delta_\tau - \Delta_{\tau+\epsilon}}{\epsilon \Delta_\tau}\right)$, which is the instantaneous probability of being voted out of office at each point in time. Based on the previous discussion and empirical analysis, we perceive this probability to be endogenously determined by trust. Thus, $p(T_t)$ represents the probability of being voted out of office which decreases with the amount of trust that voters have in their politician. The following assumptions clarify the shape of this probability function.

Assumption 2 *We assume that* $p : \mathbb{R}_+ \to \mathbb{R}_{++}$, $\lim_{T \to \infty} p(T_t) = \hat{p} > 0$, $p_T < 0$, $p_{TT} > 0$, $\lim_{T \to 0} p(T) = \infty$.

We take $\hat{p}$ to be the minimum level of $p(T_t)$ which suggests that there always exists a positive probability of being voted out of office, independently of the level of trust. The last condition $\lim_{T \to 0} p(T) = \infty$ implies that without trust the politician will be immediately evicted from office.

Assumption 3 *We assume* $2\frac{p_T(T_t)}{p(T_t)} > \frac{p_{TT}(T_t)}{p_T(T_t)}$ *and* $\lim_{T \to 0} p(T)\frac{p(T)+\delta}{p_T(T)} < 0$.

These two conditions constrain the functional forms for $p(T_t)$ that may be considered here. They are technical conditions where the first condition basically requires that, for increasing T_t, the ratio between marginal changes in p and the deviation of p from zero should be increasing. The second condition requires that $\lim_{T \to 0} p_T(T)$ should not go to infinity too quickly.[9]

2.3 The underlying empirical links

With an empirical investigation we back up our assumptions on the evolution of trust and the interplay between corruption, redistribution and trust. Table 2 shows empirical results from the 1994-1999 wave of the World Value Survey (WVS) with 43,893 individuals in a

elections. However, history has shown that e.g. elections have been antedated based on votes of no confidence, while US senators have unlimited terms as do many local governors in democratic countries. However, as a referee rightly pointed out, the model ignores potential legal accountability for crimes. We assume this away for simplicity.

[9] A function that satisfies this assumption and the previous one is, for example, $p(T_t) = \hat{p} + 1/T_t$.

cross-section of 44 countries. We have a minimum of 324 individuals in Dominican Republic, and a maximum of 1,878 replies in South Africa. We run a probit model with clustered (by countries) standard errors across all regressions. We report the marginal effects, i.e. the change in the probability for a change in the independent variables X, with the vector of coefficients β. Our basic model is

$$\Pr(\text{confidence} = 1|\mathbf{X}) = F(\mathbf{X}'\beta).$$

Confidence is the dependent variable and derives from the question "How much confidence do you have in the government?". The possible answers range from 1=(a great deal) to 4=(none at all). We recoded this variable as a dummy, denoting (1 and 2)=1 and (3 and 4)=0. Confidence thus works as a subjective measure of trust in the government. The WVS includes a question on bribing, where respondents are asked about their belief as to "How widespread do you think bribe-taking and corruption is in this country?". The possible answers range from 1=(almost none) to 4=(almost all). We recode the variable as a dummy variable, dubbed *corrupt*, that takes the value of 1 for (3 and 4) and 0 for (1 and 2). Thus, someone believing that most or all public officials are corrupt scores a 1. Since there is no direct question about re-distribution policies in the WVS we proxy redistribution by several variables. We take the amount of savings (variable *savings*) and financial satisfaction (variable *finasatis*). The variable *savings* is derived from the question: "During the past year, did your family save money (=1), just get by (=2), spent some savings and borrowed money (=3), spent savings and borrowed money (=4)." We constructed a dummy variable that takes a value of 1 in case the family had savings or just got by, and 0 if the family had to borrow money. The variable *finasatis* comes from the question: "How satisfied are you with the financial situation of your household?" It ranges from dissatisfied (=1) to satisfied (=10). We recoded this as a dummy taking the value of 0 for 1-5 and 1 for 6-10. Therefore, respondents that are satisfied will score a 1, others a 0. Our intuition is that countries with stronger social policies including better re-distribution should see more people having savings and a certain degree of financial satisfaction. We also include two more indirect proxies. One we dub *social*, which is based

on the question whether one believes that the "...country is run by a few big interests looking out for themselves, or that it is run for the benefit of all the people?". It takes the value of 0 if the respondent believes that the country is run by few big interests, while it takes the value 1 if she believes that it is run for all people. Finally, the variable *helpful* derives from the question whether the "government is doing for people in poverty in this country about the right amount, too much, or too little". We gave a 1 to those that answered 'too much' and those that answered 'about the right amount', and a 0 to those that answered 'too little'.

As controls we include the educational attainment (dummies *edu2*-*edu8*), where the benchmark *edu1* is 'not completed elementary education', while *edu8* is 'university with degree'; whether one discusses politics or not (*discuss*), with 1 denoting a regular discussion of policy matters while 0 denotes never; *sex*, with 0 denoting male and 1 female; *age*; *marital status*, where 0 denotes single and 1 married; attendance of religious meetings (*religious*), with 0 implying seldomly and 1 denoting regularly; and whether one is a *party member*, where party members receive a 1 and non-members a 0. The summary statistic of these variables is given in Table 1.

> Table 1 approximately here <

The results of this empirical investigation are as follows. Throughout regressions (1) to (4) we see that our variables of interest, namely *corrup* and our proxies for re-distribution, namely *savings*, *finasatis*, *social* and *helpful* are robust and statistically significant across all specifications. They also enter the regression with the expected signs. In model (1) we find that someone who believes that politicians are corrupt also has a 4.19% lower trust in politicians compared to someone who does not believe that politicians are corrupt. Model (2) controls for country-specific effects with country dummies, and we see that this strengthens the relationship between corruption and trust even further, to -11% instead of -4.19%. On average, individuals who believe that their government is corrupt, therefore, also have lower levels of confidence, or trust, in their government.

> Table 2 approximately here <

People that were able to save and are satisfied with their financial situation also hold a higher

level of trust in their government (at maximum 3% for either) compared to those that are not. The variables social and helpful have the strongest correlation with trust, where governments obtain a 24% higher level of trust if their voters believe that the politicians run the country for the people. In addition, individuals hold a 10% higher level of trust in their government in case they also believe that their government is doing sufficiently much against poverty in their country. The empirical results we presented here basically show that individuals' trust in their government in robustly and statistically significantly correlated with their subjective views on corruption and redistribution policies.

When adding controls, the previous results are still robust. We find that more highly educated people have lower levels of trust in politicians, while those who discuss political matters hold higher levels of trust and so do those that are party members. Sex does not have a robust impact on trust in politicians while those that regularly attend religious meetings hold a higher trust.

The existing literature further supports our results which provide the foundation for our modeling choices. Bjørnskov [15] and Alesina and La Ferrara [4] show that income inequality affects the extent of trust in society negatively. One would thus expect that good social redistribution policies reduce income inequalities and thereby increase trust. Similarly, more corruption, lower efficiency of the judiciary and a worse bureaucratic quality all reduce trust in people (La Porta et al. [40]).

3 The control problem

Our intention here is to explore possible relations between trust, corruption, income and redistributive policies. For this we build a dynamic model which is able to reveal some of the mechanics that may underlie those variables in question.

We start from the presumption that there exists a politician who obtains a constant stream of taxes $X > 0$, a constant stream of wages $Y > 0$, and may choose the amount R_t that he wants to re-distribute to his voters, as well as the amount of bribes B_t that he wants to take. Thus, the politician maximizes his utility from both net income, given by

$Z_t = X + Y - R_t + B_t > 0$, and his social motives for re-distribution of taxes, while at the same time taking into account the feedback effects on trust, and thus the probability of being voted out of office. Bribes here are for simplicity denoted in monetary terms, though may take any other form. Redistribution R_t in the felicity function suggests that the politician is, at least to some extent, benevolent and obtains own felicity from acting socially good. This is supported in an article from Vardis Fisher [29], where he notices that "The best of our public officials don't seek their positions for the money. There are other and infinitely greater rewards... There is his own respect to win and keep,... while devoting himself faithfully to the welfare of his country." This laudation should be viewed with some skepticism in the light of e.g. the amount of funds embezzled by President Suharto.[10] Nevertheless, for many politicians who would otherwise be able to earn more in the free market, one of the main incentives for being a politician could indeed come from hoping to achieve something good. As an additional interpretation one could thus think of the amount redistributed as an investment into a public good that everyone receives, including the politician.

The probability that the politician is re-elected is depending on the amount of trust T_t that his voters have in him. The more trust the voters have in the politician the higher his probability of staying in office. We assume the politician may stay in office forever, unless he is not re-elected.[11] For simplicity, we suggest that if the politician is not re-elected, then his welfare drops to zero from then on. He will not have the chance to be re-elected. A politician earns his voters' trust depending on the amount of taxes that he re-distributes and loses trust whenever he takes bribes. For our purpose it is sufficient to study a partial equilibrium case. We, therefore, simply assume that bribe supply, by voters or special interest groups, exceeds bribe demand for any level of bribes.

Assumption 4 *The felicity function* $u : \mathbb{R}^2_+ \to \mathbb{R}_+$ *is at least twice continuously differentiable with* $u(Z_t, R_t) \geq 0$, $u_Z > 0$, $u_{ZZ} < 0$, $u_R > 0$, $u_{RR} < 0$, $u_{ZR} = 0$. *Furthermore,* $\lim_{Z\to 0} u_Z = \infty$ *and* $\lim_{R\to 0} u_R = \infty$.

[10] Gorodnichenko and Peter [35] demonstrate that Ukrainian politicians have the same level of consumption expenditure and asset holdings as their private sector counterparts despite wage income that is around 40% lower. They attribute this difference to bribe taking.

[11] For example, half of the US states do not impose a term limit on their governors (see Besley and Case [13]). Others, like Hugo Chavez, manage to change the law in order to stay empowered.

We constrain the felicity function to have a positive domain for reasons forwarded in Schumacher [50]. Basically, in models of endogenous discounting one loses the property of ordinality. Meaningful results then require a positive felicity function.

We now characterize the control problem. The politician solves the control problem under uncertainty

$$U(T_0) = \max_{\{B_t, R_t\}} E_0 \left\{ \int_0^\tau u(Z_t, R_t) dt \right\} \tag{1}$$

subject to

$$\begin{aligned} Z_t &= B_t + Y + X - R_t, & (2) \\ \dot{T}_t &= G(R_t - X) - F(B_t) - \delta T_t & (3) \end{aligned}$$

As we assume that the politician uses a Poisson function to describe the evolution of uncertainty (c.f. section 2.2) we can rewrite the expectation as

$$E_0 \left\{ \int_0^\tau u(Z_t, R_t) dt \right\} = \int_0^\infty u(Z_t, R_t) e^{-\int_0^t p_s ds} dt.$$

We then define $\Delta_t = \int_0^t p_s ds$, which implies $\dot{\Delta}_t = p_t$. We can then rewrite the control problem from above as one where the politician optimizes under certainty

$$\max_{\{B_t, R_t\}} \int_0^\infty u(Z_t, R_t) e^{-\Delta_t} dt \tag{4}$$

subject to

$$\begin{aligned} Z_t &= B_t + Y + X - R_t, & (5) \\ \dot{T}_t &= G(R_t - X) - F(B_t) - \delta T_t, & (6) \\ \dot{\Delta}_t &= p(T_t) & (7) \end{aligned}$$

with $T_t \geq 0$, $B_t, R_t \geq 0$, $\forall t$, and $T_0 > 0$, $X > 0$ and $Y > 0$ given.[12] An *admissible path* is

[12] The fact that the time horizon now runs up to infinity is a result of the transformation to the certainty case. From an analytical perspective it promises an easier handling of the control problem.

defined as a trajectory $\{Z_t, B_t, R_t, T_t, \Delta_t\}_{0\leq t\leq\infty}$ which meets the constraints (5), (6) and (7) with the states T_t and Δ_t being continuous and the controls B_t and R_t piecewise continuous. A path $\{Z_t^*, B_t^*, R_t^*, T_t^*, \Delta_t^*, t\}$ is an *optimal path* if it is admissible and $\forall\{Z_t, B_t, R_t, T_t, \Delta_t, t \geq 0\}$ admissible paths we have $\int_0^\infty e^{-\Delta_t} u(Z_t^*, R_t^*)dt \geq \int_0^\infty e^{-\Delta_t} u(Z_t, R_t)dt$. We now characterize optimal paths.

3.1 Necessary conditions

The Hamiltonian of this control problem is given by

$$\mathcal{H}(B_t, R_t, \Delta_t, T_t, \lambda_t, \mu_t) = u(B_t + Y + X - R_t, R_t)e^{-\Delta_t} - \mu_t p(T_t) + \lambda_t\big(G(R_t - X) - F(B_t) - \delta T_t\big). \quad (8)$$

Where possible we neglect time subscripts from now on. In order to incorporate the possibility of corner solutions we introduce the Langrangian, given by

$$\mathcal{L} = \mathcal{H} + \phi_B B + \phi_R R. \quad (9)$$

The first order conditions are given by

$$\begin{aligned} u_Z e^{-\Delta} &= \lambda F_B - \phi_B, & (10)\\ u_Z e^{-\Delta} &= \lambda G_R + u_R e^{-\Delta} + \phi_R, & (11)\\ \dot{\lambda} &= \mu p_T + \delta\lambda, & (12)\\ \dot{\mu} &= -u e^{\Delta}. & (13) \end{aligned}$$

Lemma 1 *On the optimal path, a boundary solution in B_t or R_t is impossible.*

Proof 1 *Assume $R = 0$ and $B > 0$. From equations* (10) *and* (11) *we then obtain $u_Z e^{-\Delta} - u_R e^{-\Delta} = u_Z e^{-\Delta}\frac{G_R}{F_B} + \phi_R$. This is equivalent to*

$$\frac{u_Z - u_R}{u_Z} > \frac{G_R}{F_B}. \quad (14)$$

Since u_Z is bounded below for $R = 0$ but u_R is unbounded, then this implies that (14) *cannot*

hold. Therefore, the combination $R = 0$ *and* $B > 0$ *is impossible. For* $B = 0$ *and* $R > 0$ *we obtain the same condition as above, with the difference that* u_Z *is bounded for* $B = 0$ *and* $u_R < \infty$ *for* $R > 0$*. This implies* $\frac{G_R}{F_B} < 1 - \frac{u_R}{u_Z}$*. However, since* $F_B(0) = 0$*, then this leads to a contradiction. We can thus rule out corner solutions.*■

Assuming that an optimal path exists, which we prove below, we now know that a politician will always resort to a positive amount of re-distribution and bribe-taking. Though this may seem surprising, it is supported by e.g. the result in Caselli and Morelli [19], who show how self-selection of candidates may lead to bad politicians in office. By combining equations (10) and (11) we obtain

$$\frac{G_R}{F_B} = 1 - \frac{u_R}{u_Z}. \tag{15}$$

The right-hand side is always less than one, implying $G_R < F_B$. Since both $G_R > 0$ and $F_B > 0$, then $u_R/u_Z \in (0, 1)$. To anticipate a later result, a steady state in T requires $R > \hat{R}$, such that redistribution is able to at least offset the depreciation in trust over time. In any case, we obtain $G_R < F_B$ and $u_R < u_Z$ on the optimal path.

To give some intuition to condition (15), let us start with a special case by assuming that the politician has a negligible social incentive for re-distribution (e.g. in countries with low levels of social capital), implying $u_R = 0$.[13] In this case the marginal rate of substitution between bribe-taking and tax re-distribution is equal to one. The politician values both thus equally, and giving up one unit of bribes would have the same impact on his utility as re-distributing one more unit of taxes. Thus, in this case the optimal mix between R_t and B_t rests solely on how both influence trust, and consequently the probability of staying in office. Then $G_R = F_B$, where G_R is the marginal benefit (per unit of marginal felicity from net income) of increases in trust from re-distributing more taxes back to the citizens while F_B reflects the marginal cost (per unit of marginal felicity from net income) due to decreasing trust from taking more bribes. Thus, optimality requires that the marginal cost of re-distribution should be equal to the marginal benefit of taking more bribes.

[13] Strictly speaking, Lemma 1 does not apply in this case. However, based on a similar proof we can conclude that only interior solutions are optimal even if $u_R = 0$.

Allowing for $u_R > 0$, then $G_R < F_B$ since a larger re-distribution now adds to utility via the additional impact from the social incentives for re-distribution. Importantly, the choice between re-distribution and bribe-taking is a static efficiency one. As we shall see, changes in re-distribution and bribe-taking over time will depend on the level of trust, which affects the probability of staying in office. The optimal mix between the two depends, however, solely on their marginal contributions to utility and the way in which they impact trust, which is both independent of time and the level of trust.[14]

We now present several analytical results that we need on the subsequent analysis.

Lemma 2 *The optimized Hamiltonian* $\mathcal{H}_t^* = 0$, $\forall t$.

Proof 2 *We differentiate the optimized Hamiltonian with respect to* t.

$$\frac{d\mathcal{H}^*}{dt} = \big(u_Z(\dot{B} - \dot{R}) + u_R\dot{R}\big)e^{-\Delta} - pue^{-\Delta} - \dot{\mu}p - \mu p_T\dot{T} + \dot{\lambda}\dot{T} - \lambda\big(G_R\dot{R} - F_B\dot{B} - \delta\dot{T}\big) + \frac{\partial\mathcal{H}^*}{\partial t}.$$

Substituting the first-order conditions we derive $\frac{d\mathcal{H}^*}{dt} = \frac{\partial\mathcal{H}^*}{\partial t}$. *We make use of Michel's [44] transversality condition, which states that an optimal path necessarily requires that the Hamiltonian goes to zero when time goes to infinity. Mathematically, it requires*

$$\lim_{t\to\infty} \mathcal{H}_t = 0. \tag{16}$$

Since our Hamiltonian is autonomous, this implies that the optimized Hamiltonian is equal to zero, at any t, *such that* $\mathcal{H}_t^* = 0$, $\forall t$. ■

Using the result of this Lemma, we obtain the value of μ on the optimal path, which is given by

$$\mu = \frac{ue^{-\Delta} + \lambda\dot{T}}{p(T)} > 0. \tag{17}$$

[14]This result obtains since the current level of trust only impacts the evolution of trust through the depreciation. One could, however, very well imagine a more general functional form, like $\dot{T}_t = \vartheta(B_t, R_t, T_t)$, which would allow for trade-offs at the cost of the current level of tractability.

By integrating μ forward (based on eq. (13)), we find that it represents the prospective, discounted value of staying in office. This is given by

$$\mu_t = \int_t^\infty u(B_\tau + Y + X - R_\tau, R_\tau) e^{-\Delta_\tau} d\tau. \tag{18}$$

This result is valid as long as $\lim_{t\to\infty} \mu_t = 0$. In a similar manner we derive the value of λ_t, which is given by

$$\lambda_t = -e^{\delta t} \int_t^\infty p_{T_\tau} e^{-\delta\tau} \int_\tau^\infty u(Z_s, R_s) e^{-\Delta_s} ds d\tau > 0. \tag{19}$$

Conclusively, λ_t is the net present (in terms of trust depreciation) value of the Volterra derivative (with respect to T_t) of the felicity functional integrated over the time $\tau \in [t, \infty)$. In other words, the shadow value of trust represents the discounted change in the maximand along the optimal path if the constraint on trust is relaxed by one unit.

3.2 Sufficient condition

To show sufficiency, we need to show that the Hamiltonian is concave in the state variables. Unfortunately, the original Hamiltonian is, according to either the Mangasarian sufficiency condition or the Arrow and Kurz sufficiency condition, not concave. We, however, can transform the Hamiltonian and show that the transformed Hamiltonian (that leads to the same dynamic system as the original Hamiltonian) is concave according to the Arrow and Kurz sufficiency conditions. This method follows Nairay [45].

Proposition 1 *The necessary conditions* (10) *to* (13) *together with the transversality condition* (16) *are sufficient if Assumption 3 is satisfied.*

Proof 3 *To prove this, we reduce the dynamic system to one containing only one state equation. We transform the Hamiltonian by using* $d\Delta_t/dt = p(T_t)$*, which is equivalent to* $d\Delta_t/p(T_t) = dt$*. This is possible since* $\Delta_t \in [0, \infty)$ *and a monotonic function. We substitute*

this into the control problem (4) *and derive a new Hamiltonian*

$$\mathcal{K}_t = \frac{u(Z_t, R_t)e^{-\Delta_t}}{p(T_t)} + \lambda \frac{G(R_t - X) - F(B_t) - \delta T_t}{p(T_t)}, \tag{20}$$

with controls B_t, R_t *and the single state* T_t. *The first-order conditions of this Hamiltonian (with respect to* B_t, R_t *and* T_t*) lead to the same dynamic system as that of the original Hamiltonian* (8). *We then substitute the first-order conditions back into* (20) *and derive the Arrow and Kurz second-order sufficiency condition of the Hamiltonian* $\mathcal{K}_t$ *along the optimal path. This is given by*

$$\frac{\partial^2 \mathcal{K}^*}{\partial T^2} = \left(2\frac{p_T^2}{p^2} - \frac{p_{TT}}{p}\right)\left(\frac{u(Z^*)e^{-\Delta} + \lambda \dot{T}^*}{p}\right) + \delta\lambda\frac{p_T}{p^2}.$$

A sufficient condition for $\frac{\partial^2 \mathcal{K}^*}{\partial T^2} < 0$ *is* $2\frac{p_T}{p} > \frac{p_{TT}}{p_T}$. *This holds under Assumption 3.*■

We, furthermore, need the condition $\int_0^\infty \frac{e^{-\Delta}u(Z_t,R_t)}{p(T)}d\Delta < \infty$ in order for the utility functional to converge. Clearly, R_t is bounded by $B_t + Y + X$. Thus, for any $B_t < \infty$, $u(0, B_t + Y + X)$ is bounded and it suffices to know that $p(T_t) > \hat{p}$ for any T_t in order for $u(0, B_t + Y + X)/p(T_t)$ to be bounded. We, thus, need an assumption on how $u(Z_t, R_t)/p(T_t)$ behaves for $B_t \to \infty$. Hence, we assume that $\lim_{B\to\infty} u(Z_t, R_t)/p(T_t) < \infty$. Clearly, if $B_t \to \infty$ then $T_t \to 0$. If the felicity function then tends more slowly to infinity than the probability to be relieved from office tends to infinity, then this insures the convergence of the utility functional.[15]

3.3 The dynamics

Using equation (15) we derive that changes in B_t lead to optimal changes in R_t according to

$$\frac{dR}{dB} = \frac{(u_Z - u_R)\frac{F_{BB}}{F_B} + u_R\frac{u_{ZZ}}{u_Z}}{(u_Z - u_R)\frac{G_{RR}}{G_R} + u_{RR} + u_R\frac{u_{ZZ}}{u_Z}} \equiv \psi(R, B). \tag{21}$$

[15]Clearly, it is reasonable to assume that there exists an upper bound on B_t which is large enough in order to not affect the interior solutions but less than infinity so that the convergence of the utility functional is always assured.

We dub function $\psi(R,B)$ the 'trade-off function'. It shows how a politician trades-off tax-redistribution and bribe-taking along the optimal path. Assuming no social motive for re-distribution ($u_R = 0$) implies $\frac{dR}{dB} = \frac{F_{BB}}{G_{RR}} < 0$. In this case increases in bribe-taking on the optimal path should lead to reductions in re-distribution. This arises since the optimal choice between re-distribution and bribe-taking is a static efficiency one, where the increase in marginal benefit (per unit of marginal felicity from net income) from higher bribe-taking needs to be offset by an increase in the marginal cost (per unit of marginal felicity from net income) from re-distribution. The latter is achieved by reducing re-distribution.

Allowing for $u_R > 0$, then along the optimal path we thus have $\frac{dR}{dB} > 0$ if $-\frac{F_{BB}}{F_B}\frac{(u_Z - u_R)u_Z}{u_{ZZ}} < u_R$, implying that redistribution and bribe-taking are complements along the optimal path if the social motive for re-distribution is sufficiently strong. Otherwise, bribe-taking and re-distribution are substitutes. If both are complements then this implies that the politician, at least partly, increases bribe-taking because this allows him to increase his efforts towards his social motives.

An important result for later derivations is stated in the next lemma.

Lemma 3 *Given optimal allocations of R and B, then the trade-off function is always smaller than one, $\psi(R,B) < 1$.*

Proof 4 *We use the result in equation* (21)*. From this we obtain, after simplification, that*

$$1 - \psi = \frac{(u_Z - u_R)\left(\frac{G_{RR}}{G_R} - \frac{F_{BB}}{F_B}\right) + u_{RR}}{u_{RR} + u_R\frac{u_{ZZ}}{u_Z} + (u_Z - u_R)\frac{G_{RR}}{G_R}} > 0.$$

Thus, $\psi < 1$.■

Thus, a one unit increase in bribes along the optimal path leads to a less than one unit change in re-distribution.

Based on equation (15) we derive that both variables optimally co-evolve over time according to

$$\dot{R} = \psi(R,B)\dot{B}. \tag{22}$$

We now solve for the optimal dynamic path of the control variables. We differentiate equation

(10) with respect to time, then substitute (12), (13), (17) as well as (22) to get the system that describes the optimal path of the variables

$$\dot{B} = \frac{p(T) + \delta + \frac{p_T}{p(T)} \left(F_B \frac{u}{u_Z} + G(R - X) - F(B) - \delta T \right)}{\frac{u_{ZZ}}{u_Z}(1 - \psi(R, B)) - \frac{F_{BB}}{F_B}}, \tag{23}$$

$$\dot{R} = \psi(R, B)\dot{B}, \tag{24}$$

$$\dot{T} = G(R - X) - F(B) - \delta T. \tag{25}$$

We re-write equation (23) with the solution for the shadow value of trust in order to give some further intuition for the evolution of bribe-taking. This gives

$$\dot{B} = \frac{p(T) + \delta + \frac{p_T \mu}{u_Z e^{-\Delta}} F_B}{\frac{u_{ZZ}}{u_Z}(1 - \psi(R, B)) - \frac{F_{BB}}{F_B}} = \frac{p(T) + \delta + \frac{p_T F_B}{u_Z e^{-\Delta}} \int_t^\infty u(Z_s, R_s) e^{-\Delta_s} ds}{\frac{u_{ZZ}}{u_Z}(1 - \psi(R, B)) - \frac{F_{BB}}{F_B}}, \tag{26}$$

The denominator is always negative. A faster depreciation in trust has a negative effect on the evolution of bribe-taking. The faster trust depreciates the quicker will the probability of being voted out of office increase. In order to compensate for this the politician will reduce bribe-taking. Since $\psi < 1$, we furthermore know that re-distribution either decreases less than bribe-taking or even increases, in case the social incentives outweigh. The direct effect of a higher probability of being voted out of office is to induce an optimal decrease in bribe-taking. This direct effect plays the same role as the discount rate in a standard Ramsey-type economy.

The last term in (26) comes from the endogenous probability of being voted out of office. A low future expected stream of utility induces an increase in corruption over time. Hence, a politician from a poor country whose net income Z is small (i.e. someone who neither receives a large wage Y, nor is able to embezzle many funds) does not take the effect of changes in trust on the expected stream of utility into account. He will not be sufficiently forward-looking to care about effects on future expected utility but only be concerned with the current impact of trust on $p(T)$, where in his current position the future impact of bribes and re-distribution on trust is of little importance, and δ.

The steady state is given by

$$p(T)\frac{\delta + p(T)}{p_T} = -F_B\frac{u}{u_Z}, \tag{27}$$

$$T = \frac{1}{\delta}\big(G(R-X) - F(B)\big), \tag{28}$$

$$1 - \frac{G_R}{F_B} = \frac{u_R}{u_Z}. \tag{29}$$

These equations define the steady state of the dynamic system. We now provide results on the uniqueness of the equilibrium.

Proposition 2 *The equations* (27), (28) *and* (29) *define a unique equilibrium if Assumption 3 holds.*

Proof 5 *We substitute* $T = (G-F)/\delta$ *into the left-hand side (LHS) of equation* (27) *and define* $\Omega_1 = p(\frac{G-F}{\delta})\frac{\delta + p(\frac{G-F}{\delta})}{p_T}$ *and* $\Omega_2 = -F_B\frac{u}{u_Z}$. *The derivative with respect to* B *is*

$$\frac{d\Omega_1}{dB} = F_B\left(\frac{G_R}{F_B}\psi - 1\right)\left(\frac{2p+\delta}{\delta} - p\frac{p_{TT}}{\delta p_T^2}(\delta + p)\right).$$

We re-write the terms as follows.

$$\frac{2p+\delta}{\delta} - p\frac{p_{TT}}{\delta p_T^2}(\delta + p) = \frac{p+\delta}{\delta}\left(2 - p\frac{p_{TT}}{p_T^2}\right) - 1 < 0,$$

by Assumption 3. Also, since $\psi < 1$ *and* $G_R < F_B$ *under the interior condition, we find that the left-hand side increases monotonically in* B.

For $B \to 0$, *the right-hand side* Ω_2 *of equation* (27) *is zero. Since* $u(Z)$ *is bounded below for* $B \to 0$, *this implies that* u_Z *is bounded below, and therefore* $\lim_{B\to 0}\Omega_2(B) = 0$ *by Assumption 2. We calculate*

$$\frac{d\Omega_2}{dB} = -F_B\left[\frac{F_{BB}}{F_B}\frac{u}{u_Z} + (1-\psi)\left(\frac{u_Z^2 - uu_{ZZ}}{u_Z^2}\right) + \psi\frac{u_R}{u_Z}\right] < 0.$$

Therefore, a necessary and sufficient condition for a crossing is that $\lim_{T\to 0} p\frac{p+\delta}{p_T} < \lim_{B\to 0} -F_B\frac{u}{u_Z}$, *which holds by Assumption 3. In that case we find a unique steady state.*

■

We now analyze the stability of the dynamic system around its steady state. As we can express R_t as a contemporaneous function of B_t, we can eliminate one variable and reduce the dynamic system given by equations (23) to (25) to a system consisting of only two differential equations. We concentrate on equations (23) and (25), with $R = \omega(B)$, where $\omega(B)$ is an implicit function determining the optimal relationship between R_t and B_t that derives from equation (15).

Proposition 3 *The unique steady state of the dynamic system* (23) *and* (25)*, with* $R = \omega(B)$*, is saddle-path stable by Assumption 3.*

Proof 6 *Since* R *is a multiple of* B *on the optimal path, then we can reduce the dynamic system to a two-dimensional system. By the Implicit Function Theorem we know that equation* (29) *can be solved for a unique solution of* R *as a function of* B*, given that* $(u_Z - u_R)\frac{G_{RR}}{G_R} + u_{RR} + u_R\frac{u_{ZZ}}{u_Z} \neq 0$*, which holds for any interior solution of* R *and* B*. We denote the relationship between* R *and* B *by function* $R = \omega(B)$*, with* $\omega'(B) = \psi(\omega(B), B)$*. Therefore, our two-dimensional system is given by equations* (23) *and* (25)*, with* $R = \omega(B)$*.*

The Jacobian at the steady state is given by

$$\mathcal{J} = \begin{bmatrix} \delta + p & \frac{2p_T - p_{TT}\frac{\delta+p}{p_T}}{(1-\psi)u_{ZZ}/u_Z - F_{BB}/F_B} \\ G_R\psi - F_B & -\delta \end{bmatrix}.$$

The eigenvalues of a two-dimensional system are given by $\lambda_{1,2} = \frac{1}{2}(Tr \pm \sqrt{Tr - 4Det})$*, where* $Tr(\mathcal{J})$ *and* $Det(\mathcal{J})$ *refer to respectively the trace and determinant of the Jacobian. The trace is given by*

$$Tr(\mathcal{J}) = p(T), \tag{30}$$

and the determinant is

$$Det(\mathcal{J}) = -\delta(\delta + p) - (G_R\psi - F_B)\frac{2p_T - p_{TT}\frac{\delta+p}{p_T}}{(1-\psi)u_{ZZ}/u_Z - F_{BB}/F_B} < 0, \tag{31}$$

by Assumption 3, the fact that $\psi < 1$ *and* $G_R < F_B$ *for an interior solution.* ■

Conclusively, this result allows us to proceed with a comparative static analysis.

4 Comparative statics

We derive several steady state comparative statics now. We focus on changes in the politician's wage income and taxes received, as well as social capital and electoral accountability. In all cases we relate the theoretical results to those obtained in the empirical literature.

4.1 Income and taxes

Proposition 4 *Steady state bribe-taking decreases with increases in the politician's wage income, while redistribution decreases if $\psi > 0$ and increases otherwise. Increases in wages always increase trust.*

Proof 7 *We study the steady state equations* (27) *to* (29)*. We derive*

$$\frac{dB}{dY} = -\frac{1 - uu_{ZZ}/u_Z^2}{\left(\frac{G_R}{F_B}\psi - 1\right)\left(\frac{p+\delta}{\delta}(2 - p\frac{p_{TT}}{p_T^2}) - 1\right) + \frac{F_{BB}u}{F_B u_Z} + (1-\psi)(1 - u\frac{u_{ZZ}}{u_Z^2}) + \psi\frac{u_R}{u_Z}} < 0.$$

The denominator is positive by Proof 5. Since we know that $\frac{dB}{dR} = \psi$, and $\psi < 1$, then the statement in the proposition follows immediately. Finally,

$$\frac{dT}{dY} = (G_R\psi - F_B)\frac{dB}{dY} > 0.$$

This holds since $G_R\psi < F_B$. ■

Our model thus predicts that a rise in the politician's wage income will reduce bribe-taking while it may increase or decrease his tax re-distribution. Tax re-distribution will decrease if social incentives are small.

These results support the empirical analysis in Coates [21] who studies whether there is a correlation between a state's economic performance and its politician's pay. The positive correlation between salary and the quantity of legislation passed suggests that, indeed, a higher salary provides more incentives for the politician to act in the interests of his voters. A similar result is obtained when combining results in Di Tella and Fisman (2001), who show that income per capita is positively related to increases in governors' wages, and Paldam [48],

who finds that the transition from poor to rich countries reduces corruption. Both results together suggest that a higher income per capita leads to a rise in the politician's wage which implies a lower level of corruption. Outside of the political world, the same result has been shown in Di Tella and Schargrodsky [23], who conclude that higher wages improve corruption problems (if auditing increases, too), echoing results in Becker and Stigler [11]. Finally, Rijckeghem and Weder [55], Besley [12] and Goel and Rich [34] show that a politician's pay and his performance are positively correlated.

A potential caveat to this analysis, and the model in general, is that a politician's pay could be conditioned upon past performance. In this case, a better performance of a politician in the past could have lead to an increased wage. Thus, in the terminology of our model, e.g. an increase in tax-redistribution R_t in the past could potentially have an impact on a politician's salary Y. It is clear that we do not allow for this kind of endogenous feedback in the model since we assume that a politician's wage is considered to be exogenous.

Proposition 5 *Steady state bribe-taking may increase or decrease with increases in taxes received, while redistribution moves in the opposite direction if $\psi < 0$ and in the same direction otherwise. Changes in trust move in the same direction as changes in bribe-taking.*

Proof 8 *We study the steady state equations* (27) *to* (29)*. We derive*

$$\frac{dB}{dX} = -\frac{1}{F_B} \frac{G_R \frac{p+\delta}{p}(2 - p\frac{p_{TT}}{p_T^2}) + F_B(1 - uu_{ZZ}/u_Z^2)}{\left(\frac{G_R}{F_B}\psi - 1\right)\left(\frac{p+\delta}{\delta}(2 - p\frac{p_{TT}}{p_T^2}) - 1\right) + \frac{F_{BB}u}{F_B u_Z} + (1-\psi)(1 - u\frac{u_{ZZ}}{u_Z^2}) + \psi\frac{u_R}{u_Z}}.$$

The denominator is positive by Proof 5. The numerator is positive if $-G_R\frac{p+\delta}{p}(2 - p\frac{p_{TT}}{p_T^2}) < F_B(1 - uu_{ZZ}/u_Z^2)$. Since we know that $\frac{dB}{dR} = \psi$, and $\psi < 1$, then the statement in the proposition follows immediately. Finally,

$$\frac{dT}{dX} = (G_R\psi - F_B)\frac{dB}{dX}.$$

We have that $G_R\psi < F_B$. Thus, $sgn\left(\frac{dT}{dX}\right) = -sgn\left(\frac{dB}{dX}\right)$. ■

Increases in taxes received have two opposing effects on optimal bribe-taking. On the one hand, they work as increases to net income and therefore make reductions in bribe-taking more worthwhile. On the other hand, they change the citizens' expectations about the amounts that need to be re-distributed and therefore make the current level of re-distribution less sufficient. Thus, for a given amount of re-distribution, increases in taxes received induce a decrease in trust and thereby lead to an increase in the probability of political instability. If the income effect outweighs the political instability effect then bribe-taking decreases. This result is in line with the empirical findings in Fan et al. [27] who show that if governments receive more taxes then this generally reduces bribery.

4.2 Social capital

Assume now that a politician obtains a larger marginal felicity from his social policy. This is in line with the results in Banfield (1958), Putnam (1993), Alesina and Glaeser (2004) and Tabellini (2005), namely that social capital can predict government performance. We already had introduced the additive separability of the felicity function in Z_t and R_t in Assumption 4. Thus, without any loss of generality, we take it that $u(Z,R) = \tilde{u}(Z) + \phi\tilde{v}(R)$, such that $\phi > 0$ represents the extent of social capital in society.[16] For $\phi = 0$ social incentives do not influence a politician's choices, while for $\phi > 0$ a politician's optimal decisions are affected by his social preferences. Furthermore, the larger is ϕ, the more important becomes a politician's social incentives for tax-redistribution, $\tilde{v}(R)$, relative to his personal incentives for simply gaining felicity from his own net income.

Proposition 6 *Steady state bribe-taking decreases with higher social capital, whereas redistribution increases if $\psi < 0$, otherwise it decreases. Trust increases with higher social capital.*

Proof 9 *We obtain comparative statics with respect to ϕ*

$$\frac{dB}{d\phi} = -\frac{\tilde{v}(R)/\tilde{u}_Z}{\left(\frac{G_R}{F_B}\psi - 1\right)\left(\frac{p+\delta}{\delta}(2 - p\frac{p_{TT}}{p_T^2}) - 1\right) + \frac{F_{BB}u(Z,R)}{F_B\tilde{u}_Z} + (1-\psi)(1 - u(Z,R)\frac{\tilde{u}_{ZZ}}{\tilde{u}_Z^2}) + \psi\frac{\tilde{v}_R}{\tilde{u}_Z}} < 0.$$

[16] A similar modeling approach for social capital is used in Glaeser et al. [33].

The denominator is positive by Proof 5. Since $\frac{dB}{dR} = \psi$ *and* $\psi < 1$*, then the result follows directly. Finally,*

$$\frac{dT}{d\phi} = (G_R\psi - F_B)\frac{dB}{d\phi} > 0.$$

This holds since $G_R\psi < F_B$*.* ■

This, therefore, presents theoretical support of the empirical literature on the relationship between social capital and governmental performance. A stronger preference towards social redistribution will induce politicians to increase the money that they redistribute to the agents and it will reduce their bribe-taking. They thus obtain a higher level of trust in society and this in turn reduces political stability. This is also in line with the results in Fisman and Miguel [30], who show that diplomats from countries with stronger social norms (or higher social capital) accumulate fewer unpaid parking tickets.

4.3 Electoral accountability

An important result in the empirical literature concerns the relationship between democracy and electoral accountability. Among others, Ferejohn [28] and Chowdhury [20] have shown that democracy has a significant impact on corruption through electoral accountability. We can analyze this via comparative statics on the probability of being re-elected. If the voters' trust does not significantly affect the probability of being re-elected, then one would believe that bribe-taking increases while redistribution decreases.

Mathematically speaking, we want a steeper slope of p when T changes. At the same time, we want to keep p for that particular level of T constant. This allows us to isolate the pure comparative static effect of a change in electoral accountability. We thus re-define the probability $p(T)$ of being voted out of office as follows.

Assumption 5 *We assume that* $p(T) = y(\beta, \beta T)$*, with* $y_1 > 0$*,* $y_2 < 0$ *and* $y_{22}T < -y_{21}$*.*

Conditions $y_1 > 0$ and $y_2 < 0$ are required to keep the level constant while changing the slope, while condition $y_{22}T < -y_{21}$ implies that the slope of p_T becomes more negative. We then assume that if β, the proxy for electoral accountability, changes, then $dy = \{y_1 + Ty_2\}d\beta = 0$.

Thus, changes in β keep the level constant, allowing us to isolate the comparative static effect of electoral accountability. Figure 4 gives a graphical illustration of this.

> Figure 1 approximately here <

Proposition 7 *Improvements in electoral accountability induce a decrease in bribe-taking, an increase in redistribution if $\psi < 0$ and a decrease otherwise. Steady state trust increases with improvements in electoral accountability.*

Proof 10 *We obtain*

$$\frac{dB}{d\beta} = \frac{1}{F_B} \frac{y \frac{\delta+y}{\beta y_2} \left(\frac{1}{\beta} + \frac{y_{22}T + y_{21}}{y_2} \right)}{\left(\frac{G_R}{F_B}\psi - 1 \right) \left(\frac{p+\delta}{\delta}(2 - p\frac{p_{TT}}{p_T^2}) - 1 \right) + \frac{F_{BB}u}{F_B u_Z} + (1-\psi)(1 - u\frac{u_{ZZ}}{u_Z^2}) + \psi \frac{u_R}{u_Z}}.$$

We already know that the denominator is positive. The numerator is negative if

$$-\beta \frac{y_{22}T + y_{21}}{y_2} < 1.$$

This holds by Assumption 5. The arguments regarding the effect on R and T follow from the proofs above. ■

Conclusively, a politician will reduce equilibrium trust if he knows that his probability of being re-elected is less dependent on trust. This is exactly the mechanism that many politicians use in order to increase their probability of staying in office. When, for example, Berlusconi noticed that his voters' trust decreased since he was pursued for corruption affairs, he simply implemented a law that gave him immunity from prosecution while in office. Other politicians take up even more drastic methods. When Robert Mugabe tied with Tsvangirai in Zimbabwe's national election of 2008 in the first round, his party used violence and intimidation to win the elections with over 85% in the second round. Therefore, trust might influence the probability of being re-elected, but not if other means may impact that probability, too.

In that respect, our model may also apply to the relationship between media and informational problems in elections. For example, Djankov et al. [24] find a significant correlation

between media ownership and election outcomes. Similarly, Strömberg [51] shows how the media can affect the re-distribution of taxes (through the New Deal stimulus), while Brunetti and Weder [17] conclude that a free press may reduce corruption. Finally Goel and Rich [34] find that the probability of being convicted reduces the acceptance of bribes.[17]

5 Conclusion

In this article we have shown how a politician might trade off corruption and tax embezzlement when trying to maximize his income but at the same time knowing that higher corruption reduces the trust his citizens have in him and thereby affect his future probability of re-election. We have shown that politicians may view their bribe-taking and tax embezzlement as substitutes, but only if they have weak social incentives for good policy. Clearly, we do not want to neglect the possibility that politicians have social incentives when taking office. In this case, politicians with strong social motives would view bribe-taking and good re-distributive policies (that means little tax embezzlement) as complements. This may occur in an arguably less realistic case, namely if politicians intend to increase their bribe-taking in order to be able to improve their tax re-distribution.

We found that a higher politician's income lowers his incentives for being corrupt and increases his citizens' steady state trust. This finding is also supported in Billger and Goel [14], who empirically show that richer countries have lower levels of corruption. Our analytical model presents a possible causal channel for their empirical claim. Our further results showed that stronger social capital leads to lower corruption levels. This is in line with the empirical results in Putnam [49], La Porta et al. [40], Fukuyama [31], Alesina and Glaeser [3], Algan and Cahuc [7] as well as Guiso, Sapienza and Zingales [37], [38]. Our last result was that a better electoral accountability decreases corruption. This result reveals a possible theoretical link between media and informational problems in elections. This has been shown empirically in Djankov et al. [24] or Brunetti and Weder [17], who notice a correlation between media ownership and election outcomes. Strömberg [51] shows how the media can affect the re-

[17] This is also consistent with the result in Corman and Mocan [22], Fisman and Miguel [30] and Levitt [41] that law enforecement reduces crime rates.

distribution of taxes. These results are similar to those in Ferejohn [28], Billger and Goel [14] or Chowdhury [20], who have shown that democracy has an impact on corruption through electoral accountability.

References

[1] Ades, A., and Di Tella, R. Rents, competition, and corruption. *The American Economic Review 89*, 4 (1999), 982–993.

[2] Aidt, T. Economic analysis of corruption: a survey. *Economic Journal* (2003), 632–652.

[3] Alesina, A., and Glaeser, E. *Fighting poverty in the US and Europe: A world of difference*. Oxford University Press, USA, 2006.

[4] Alesina, A., and La Ferrara, E. Who trusts others? *Journal of Public Economics 85*, 2 (2002), 207–234.

[5] Alesina, A., Ozler, S., Roubini, N., and Swagel, P. Political Instability and Economic Growth. *Journal of Economic Growth 1*, 2 (1996), 189–211.

[6] Alesina, A., and Tabellini, G. External debt, capital flight and political risk. *Journal of International Economics 27*, 3-4 (1989), 199–220.

[7] Algan, Y., and Cahuc, P. Civic virtue and labor market institutions. *American Economic Journal: Macroeconomics 1*, 1 (2009), 111–145.

[8] Baksi, S., Bose, P., and Pandey, M. The impact of liberalization on bureaucratic corruption. *Journal of Economic Behavior and Organization 72*, 1 (2009), 214–224.

[9] Bardhan, P. Corruption and development: A review of issues. *Journal of Economic Literature 35*, 3 (1997), 1320–1346.

[10] Barro, R. Economic growth in a cross section of countries. *The Quarterly Journal of Economics* (1991), 407–443.

[11] Becker, G., and Stigler, G. Law enforcement, malfeasance, and compensation of enforcers. *The Journal of Legal Studies* (1974), 1–18.

[12] Besley, T. Joseph Schumpeter Lecture: Paying Politicians: Theory and Evidence. *Journal of the European Economic Association 2*, 2-3 (2004), 193–215.

[13] Besley, T., and Case, A. Does electoral accountability affect economic policy choices? Evidence from gubernatorial term limits. *The Quarterly Journal of Economics* (1995), 769–798.

[14] Billger, S., and Goel, R. Do existing corruption levels matter in controlling corruption? Cross-country quantile regression estimates. *Journal of Development Economics 90*, 2 (2009), 299–305.

[15] Bjørnskov, C. Determinants of generalized trust: A cross-country comparison. *Public Choice 130*, 1 (2007), 1–21.

[16] Blackburn, K., and Forgues-Puccio, G. Why is corruption less harmful in some countries than in others? *Journal of Economic Behavior and Organization* (2009).

[17] Brunetti, A., and Weder, B. A free press is bad news for corruption. *Journal of Public Economics 87*, 7-8 (2003), 1801–1824.

[18] Campos, N., and Nugent, J. Who is afraid of political instability? *Journal of Development Economics 67*, 1 (2002).

[19] Caselli, F., and Morelli, M. Bad politicians. *Journal of Public Economics 88*, 3-4 (2004), 759–782.

[20] Chowdhury, S. The effect of democracy and press freedom on corruption: an empirical test. *Economics Letters 85*, 1 (2004), 93–101.

[21] Coates, D. Efficiency wages for politicians: Do better paid elected officials produce better outcomes? *University of Maryland, Baltimore. Manuscript* (1999).

[22] Corman, H., and Mocan, H. A time-series analysis of crime, deterrence, and drug abuse in New York City. *The American economic review 90*, 3 (2000), 584–604.

[23] Di Tella, R., and Schargrodsky, E. The Role of Wages and Auditing during a Crackdown on Corruption in the City of Buenos Aires. *The Journal of Law and Economics 46*, 1 (2003), 269–292.

[24] Djankov, S., McLiesh, C., Nenova, T., and Shleifer, A. Who Owns the Media? *The Journal of Law and Economics 46*, 2 (2003), 341–382.

[25] Dobson, R. *Transparency International Global Corruption Report*. Transparency International, 2009.

[26] Easterly, W. *The elusive quest for growth*. MIT press, 2002.

[27] Fan, C., Lin, C., and Treisman, D. Political decentralization and corruption: Evidence from around the world. *Journal of Public Economics 93*, 1-2 (2009), 14–34.

[28] Ferejohn, J. Incumbent performance and electoral control. *Public choice 50*, 1 (1986), 5–25.

[29] Fisher, V. Salaries of politicians. *The Idaho Statesman http://library.boisestate.edu/special/fishercolumn/number8.htm* (1945), January 16.

[30] Fisman, R., and Miguel, E. Corruption, norms, and legal enforcement: Evidence from diplomatic parking tickets. *Journal of Political Economy 115*, 6 (2007), 1020–1048.

[31] Fukuyama, F. *Trust: The social virtues and the creation of prosperity*. Free Press, 1996.

[32] Gerring, J., and Thacker, S. Political institutions and corruption: The role of unitarism and parliamentarism. *British Journal of Political Science 34*, 02 (2004), 295–330.

[33] Glaeser, E. L., Laibson, D., and Sacerdote, B. An economic approach to social capital. *The Economic Journal 112*, 483 (2002).

[34] Goel, R., and Rich, D. On the economic incentives for taking bribes. *Public Choice 61*, 3 (1989), 269–275.

[35] Gorodnichenko, Y., and Sabirianova Peter, K. Public sector pay and corruption: Measuring bribery from micro data. *Journal of Public Economics 91*, 5-6 (2007), 963–991.

[36] Grossman, H. A general equilibrium model of insurrections. *The American Economic Review 81*, 4 (1991), 912–921.

[37] Guiso, L., Sapienza, P., and Zingales, L. The role of social capital in financial development. *The American Economic Review 94*, 3 (2004), 526–556.

[38] Guiso, L., Sapienza, P., and Zingales, L. Does culture affect economic outcomes? *The Journal of Economic Perspectives* (2006), 23–48.

[39] Kaufmann, D., Kraay, A., and Mastruzzi, M. Governance matters viii: aggregate and individual governance indicators, 1996-2008. *World Bank Policy Research Working Paper No. 4978* (2009).

[40] La Porta, R., Lopez-de Silanes, F., Shleifer, A., and Vishny, R. Trust in large organizations. *The American Economic Review 87*, 2 (1997), 333–338.

[41] Levitt, S. Juvenile crime and punishment. *Journal of Political Economy 106*, 6 (1998), 1156–1185.

[42] Mauro, P. Corruption and growth. *The Quarterly Journal of Economics* (1995), 681–712.

[43] Mauro, P. Corruption and the composition of government expenditure. *Journal of Public Economics 69*, 2 (1998), 263–279.

[44] Michel, P. On the transversality condition in infinite horizon optimal problems. *Econometrica* (1982), 975–985.

[45] Nairay, A. Asymptotic behavior and optimal properties of a consumption-investment model with variable time preference. *Journal of Economic Dynamics and Control 7*, 3 (1984), 283 – 313.

[46] Nye, J. Corruption and political development. *American Political Science Review 61*, 2 (1967), 417–427.

[47] Olken, B. Monitoring corruption: Evidence from a field experiment in Indonesia. *Journal of Political Economy 115*, 2 (2007), 200–249.

[48] Paldam, M. The cross-country pattern of corruption: economics, culture and the seesaw dynamics. *European Journal of Political Economy 18*, 2 (2002), 215–240.

[49] Putnam, R. *Making Democracy Work: Civic Traditions in Modern Italy.* Princeton, NJ: Princeton University Press, 1993.

[50] Schumacher, I. Endogenous discounting and the domain of the felicity function. *Economic Modelling 28*, 1-2 (2011), 574–581.

[51] Strömberg, D. Radio's Impact on Public Spending. *Quarterly Journal of Economics 119*, 1 (2004), 189–221.

[52] Svensson, J. Who Must Pay Bribes and How Much? Evidence from A Cross Section of Firms. *Quarterly Journal of Economics 118*, 1 (2003), 207–230.

[53] Treisman, D. The causes of corruption: a cross-national study. *Journal of Public Economics 76*, 3 (2000), 399–458.

[54] Uslaner, E. Trust and corruption. *Corruption and the New Institutional Economics. London: Routledge* (2004), 76–92.

[55] Van Rijckeghem, C., and Weder, B. Bureaucratic corruption and the rate of temptation: do wages in the civil service affect corruption and by how much? *Journal of Development Economics 65* (2001), 307–331.

6 Appendix

Table 1: Summary statistics

Variable	Mean	(Std. Dev.)	Min.	Max.	N
confidence	0.425	(0.494)	0	1	43,893
corrupt	0.673	(0.469)	0	1	43,893
social	0.26	(0.438)	0	1	43,893
helpful	0.264	(0.441)	0	1	43,893
savings	0.704	(0.457)	0	1	43,893
finasatis	0.425	(0.494)	0	1	43,893
edu2	0.136	(0.343)	0	1	43,893
edu3	0.088	(0.283)	0	1	43,893
edu4	0.216	(0.411)	0	1	43,893
edu5	0.094	(0.291)	0	1	43,893
edu6	0.157	(0.364)	0	1	43,893
edu7	0.074	(0.261)	0	1	43,893
edu8	0.166	(0.372)	0	1	43,893
discuss	0.742	(0.438)	0	1	43,893
party member	0.181	(0.385)	0	1	43,893
sex	0.507	(0.5)	0	1	43,893
age	41.156	(15.729)	15	93	43,893
marital	0.664	(0.472)	0	1	43,893
religious	0.359	(0.48)	0	1	43,893

Table 2: Determinants of trust in politicians

VARIABLES	(1) confidence	(2) confidence	(3) confidence	(4) confidence
Model	*Probit*	*Probit*	*Probit*	*Probit*
corrupt	-0.0419*	-0.111***	-0.0464**	-0.110***
	(0.0240)	(0.0142)	(0.0218)	(0.0139)
social	0.241***	0.230***	0.234***	0.226***
	(0.0266)	(0.0237)	(0.0250)	(0.0237)
helpful	0.0975***	0.114***	0.0926***	0.111***
	(0.0240)	(0.0158)	(0.0230)	(0.0152)
savings	0.0383***	0.0224***	0.0417***	0.0224***
	(0.0145)	(0.00706)	(0.0131)	(0.00705)
finasatis	-0.0100	0.0386**	-0.0128	0.0435***
	(0.0170)	(0.0150)	(0.0166)	(0.0139)
edu2			-0.0486**	-0.0232
			(0.0204)	(0.0169)
edu3			-0.0901***	-0.0549**
			(0.0316)	(0.0215)
edu4			-0.0681**	-0.0725***
			(0.0288)	(0.0186)
edu5			-0.0740**	-0.0721***
			(0.0306)	(0.0176)
edu6			-0.0390	-0.0664***
			(0.0341)	(0.0222)
edu7			-0.105***	-0.0669***
			(0.0312)	(0.0201)
edu8			-0.0752**	-0.0870***
			(0.0296)	(0.0219)
discuss			0.0117	0.0210**
			(0.0151)	(0.00828)
party member			0.0517**	0.0459***
			(0.0235)	(0.0111)
sex			-0.0145*	-0.00614
			(0.00857)	(0.00701)
age			-5.41e-05	0.000783*
			(0.000627)	(0.000452)
marital			0.0247***	0.00817
			(0.00846)	(0.00721)
religious			0.0489**	0.0278**
			(0.0223)	(0.0124)
Country dummies	no	yes	no	yes
Stand. Err.	cluster	cluster	cluster	cluster
Observations	43,893	43,893	43,893	43,893
Wald	184.72		341.83	
	(0.000)		(0.000)	
Pseudo R^2	0.05	0.12	0.056	0.13
mean VIF	1.77	1.31	2.45	2.19
correctly classified	64.12%	67.75%	64.31%	68.09%

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Figure 1: Trust in Politicians versus Corruption

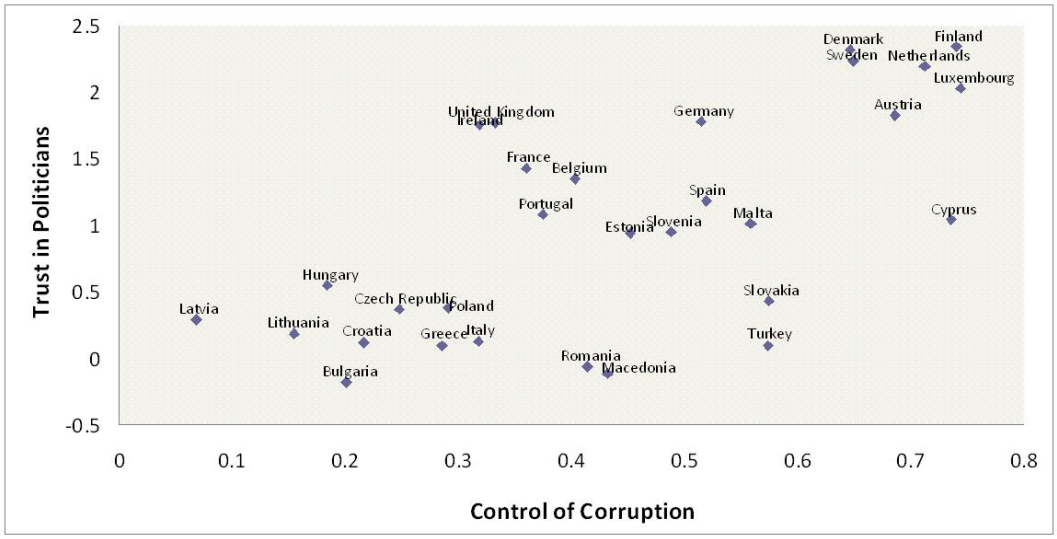

Figure 2: Control of Corruption versus Political Stability

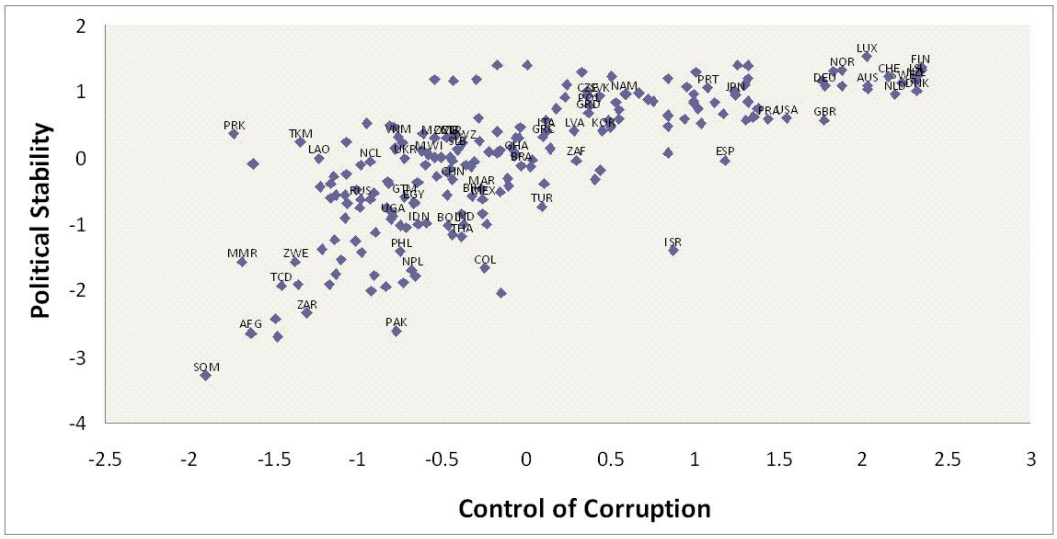

Figure 3: Trust in Politicians versus Political Stability

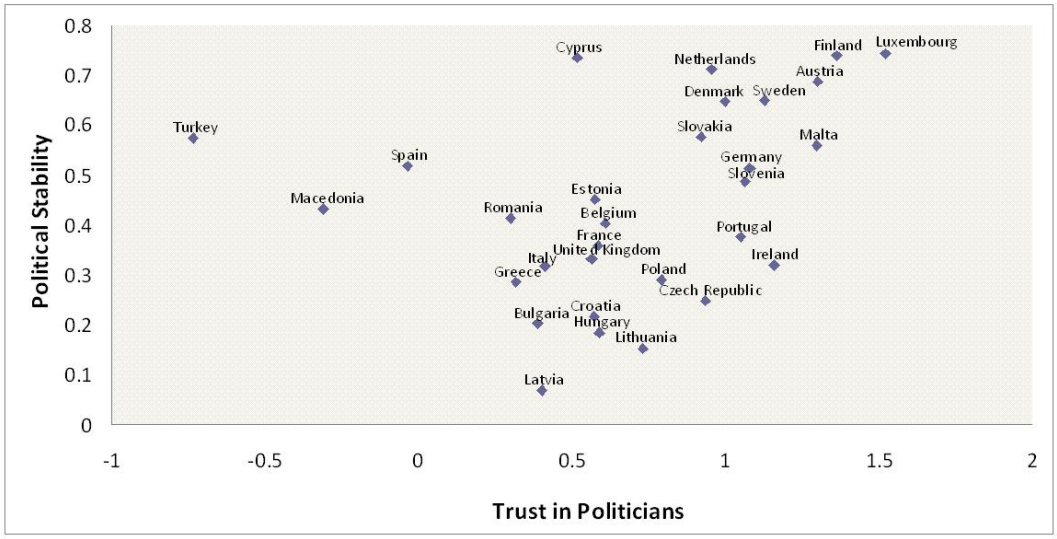

Figure 4: Change in β while keeping the level of p constant